National Transportation Safety Board

Examining Fatigue Factors in Accident Investigations: An NTSB Perspective

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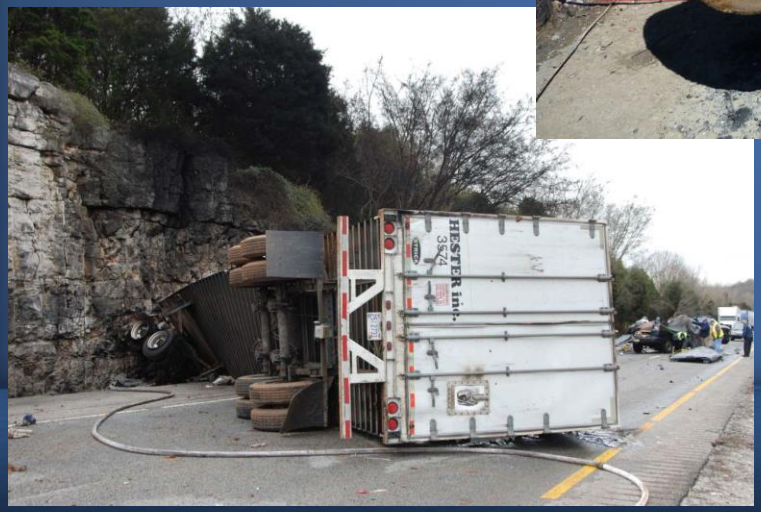
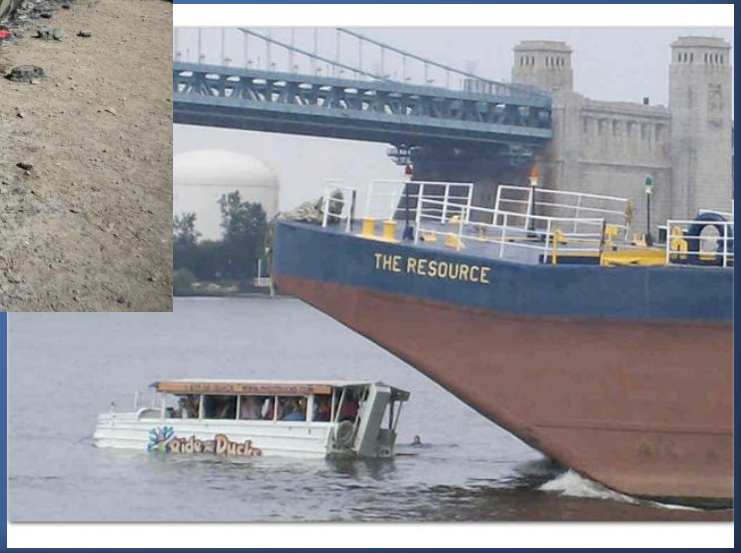
1) determining the probable cause of transportation accidents

2) making recommendations to prevent their recurrence

All Modes





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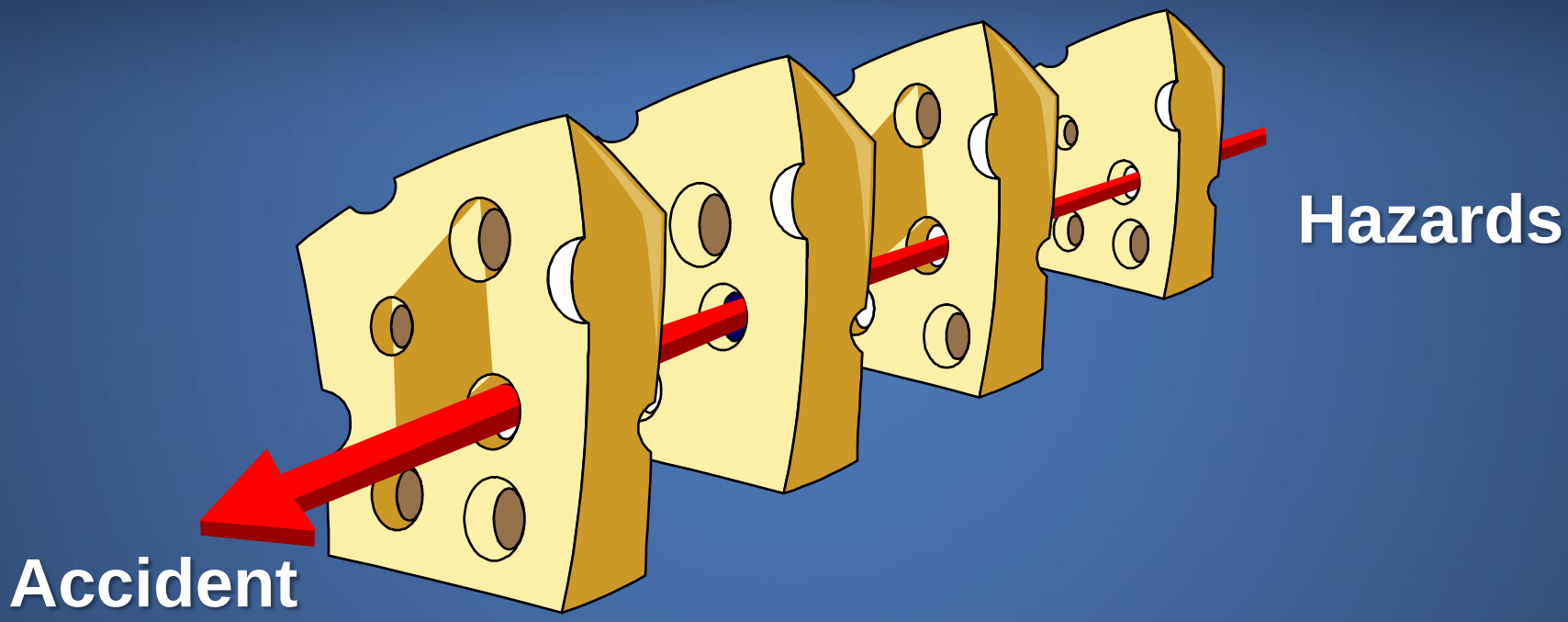
Independent Federal Agency: Created in 1967

- ~ 132,000 accident investigations
- 13,500+ safety recommendations
- ~ 2,500 organizations/recipients
- 82% acceptance rate

“Swiss Cheese” Model (Reason)



Successive layers of defenses, barriers, and safeguards

NTSB Go Team: 24/7/365

- Individual investigator
- Regional/limited team
- Major launch/Board Member

Key On-scene Events

Organizational Meeting

- Designate parties and party coordinators
- Establish and organize groups

Progress Meetings

- Summarize findings
- Info for briefings

Family Briefings

Press Briefings

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NTSB Investigative Process

On-scene Investigation

- Organizational Meeting
- Groups and Parties
- Progress meetings
- Media Briefings
- Press Releases

Preliminary Report

- Factual information

Public Hearing

- Fact finding
- Depositions
- Witnesses
- Docket

Board Meeting

- Docket
- Findings
- Conclusions
- Probable Cause
- Safety Recommendations

Final Report

Government in the Sunshine Act

NTSB Characterized as:

‘moral compass and industry conscience’

NTSB Chairman Deborah A.P. Hersman

Go! Flight 1002

- early starts, multiple segment days, sleep apnea

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Honorable John K. Lauber:

No Accident ≠
Safe Operation

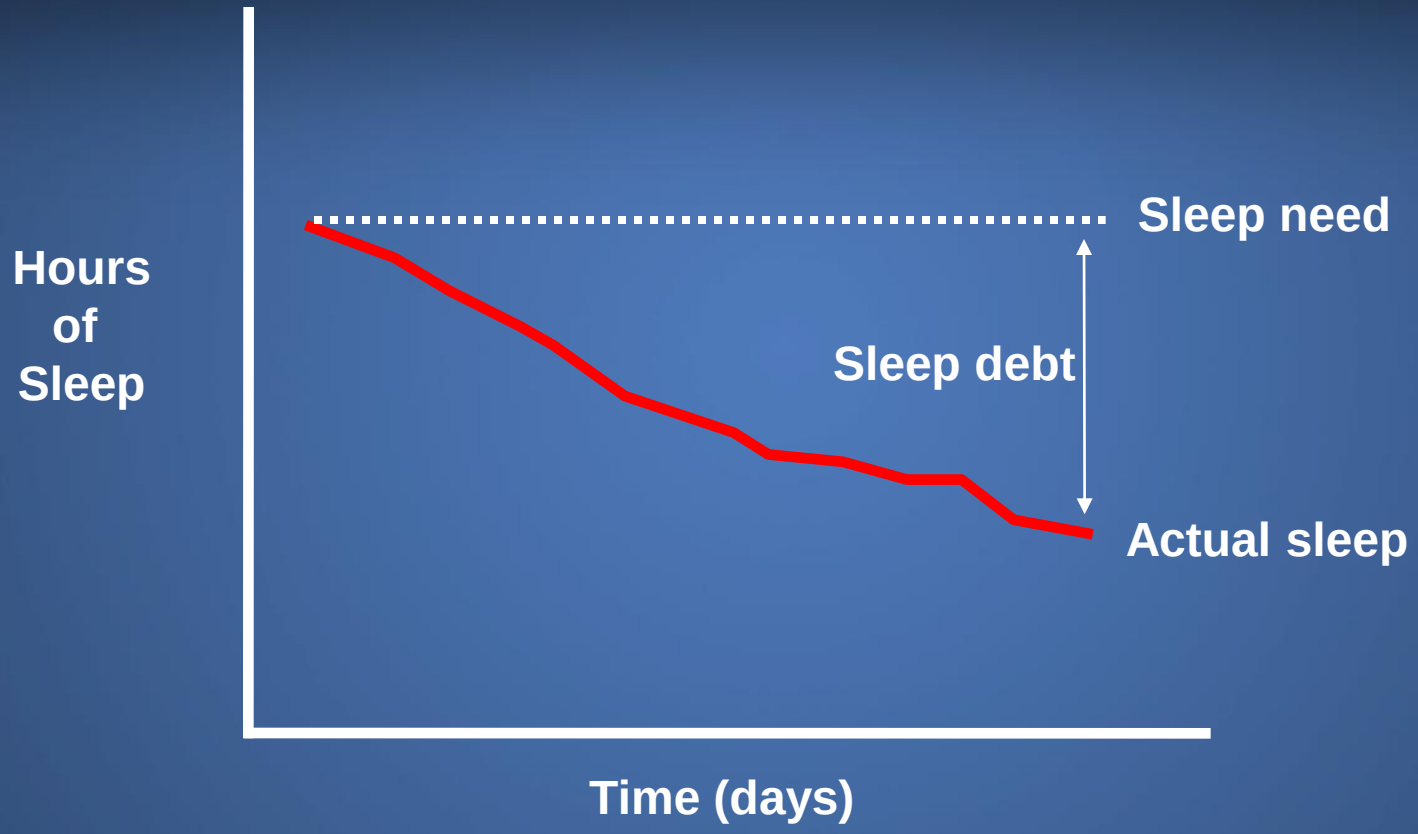
Four Fatigue Factors +

- Sleep loss
- Continuous hours of wakefulness
- Circadian/time of day
- Sleep disorders
- Other considerations

Fatigue Factors

- sleep loss
  - acute sleep loss
  - cumulative sleep debt
- hours awake
- circadian clock
- sleep disorders

Cumulative Sleep Debt



Sleep Need – Actual Sleep = Sleep Debt

Sleep debt grows cumulatively over time

Fatigue Factors

- sleep
- hours awake
  - > 12 hrs
  - > 16 hrs
  - 24 hrs
- circadian clock
- sleep disorders

Fatigue Factors

- sleep
- hours awake
- circadian clock
  - ‘sleepy’ windows
  - ‘alert’ windows
  - irregular schedule
  - time zones
- sleep disorders

Fatigue Factors

- sleep
- circadian clock
- hours awake
- sleep disorders
  - ~ 90 sleep disorders
  - sleep apnea

Four Fatigue Factors +

- Other considerations (examples)
  - environment
  - task requirements
  - medical history/medications
  - alertness strategies

Four Fatigue Factors +

- Sleep loss
- Continuous hours of wakefulness
- Circadian/time of day
- Sleep disorders
- Other considerations

Fatigue Factors in Accident

- Identify if fatigue factors were present or not present at time of the accident
- Determine #/severity of fatigue factors
- Determine if fatigue factors present at the time of the accident affected performance changes that were contributory or causal to the accident

Uncontrolled In-Flight Collision with Terrain
AIA Flight 808, Douglas DC-8-61, N814CK
U.S. NAS, Guantanamo Bay, Cuba, August 18, 1993

First NTSB aviation accident investigation
to cite fatigue as probable cause

- acute sleep loss, sleep debt, circadian disruption

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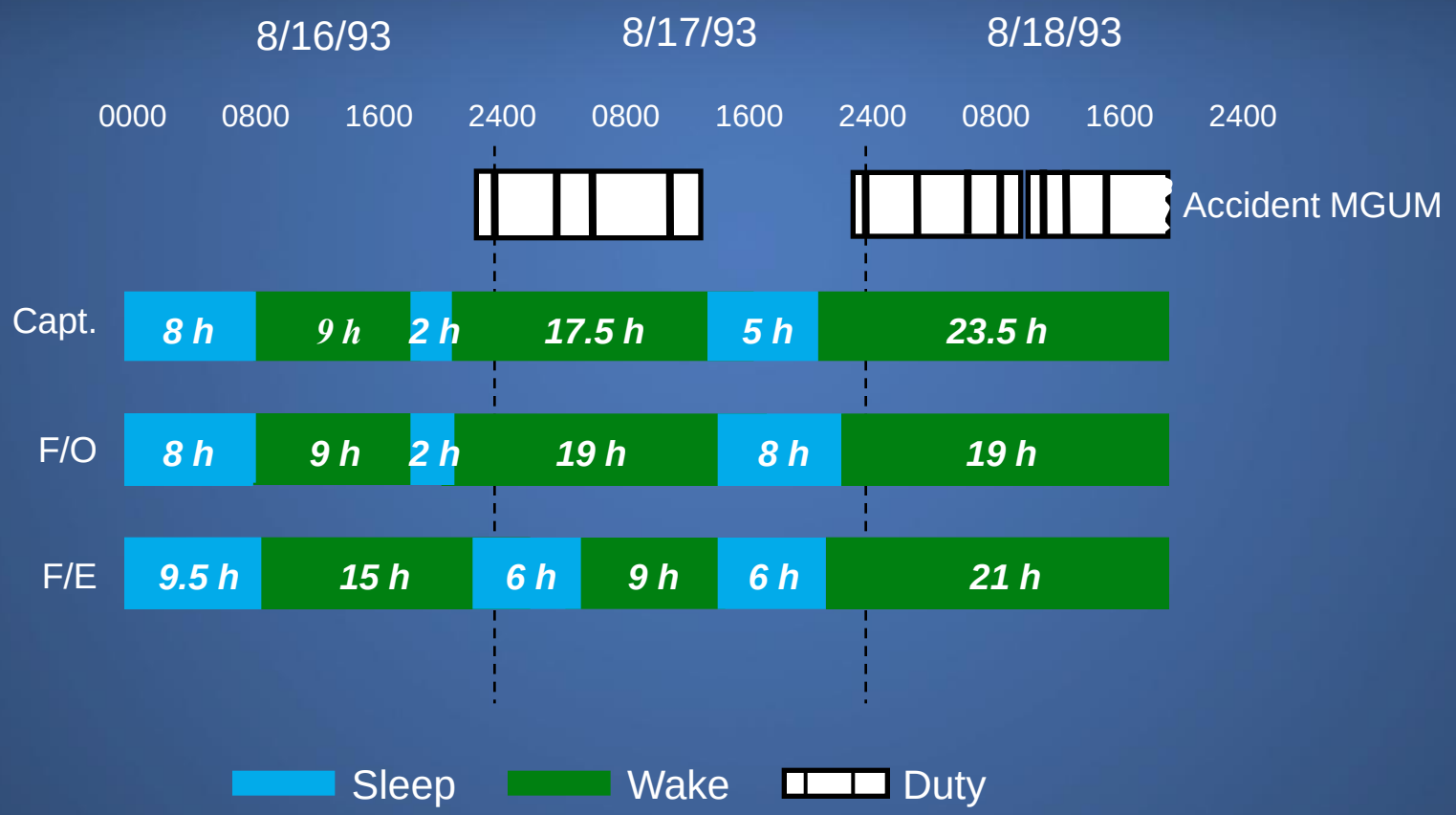
Crew Sleep History



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Observed Performance Effects

- Degraded decision-making
- Visual/cognitive fixation
- Poor communication/coordination
- Slowed reaction time

Uncontrolled In-Flight Collision with Terrain
AIA Flight 808, Douglas DC-8-61, N814CK
U.S. NAS, Guantanamo Bay, Cuba, August 18, 1993

"The National Transportation Safety Board determines that the probable causes of this accident were the impaired judgment, decision making, and flying abilities of the captain and flight crew due to the effects of fatigue…"

Owatonna, MN (July 31, 2008)

8 fatalities

NTSB

Owatonna Crew Fatigue Factors

- acute sleep loss (Capt/FO)
- cumulative sleep debt (FO)
- early start time (Capt/FO)
- excessive sleep need (Capt)
- insomnia (FO)
- self-medicate/prescription sleep med (FO)

Probable Cause/Contributing Factors

"Contributing to the accident were . . . (2) fatigue, which likely impaired both pilots' performance; . . ."

Lubbock, TX (January 27, 2009)

2 injuries

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Probable Cause/Contributing Factors

"Contributing to the accident were . . .

4) fatigue due to the time of day in which the accident occurred and a cumulative sleep debt, which likely impaired the captain's performance."

Miami, Oklahoma (June 26, 2009)
Fatigue Factors

- Off work for 3 weeks: day active/night sleep schedule
- 3am to 3pm shift work/drive schedule (since 1997)
- Early bedtime (2 hr phase advance in sleep time)
- Obtained min 3 hrs/max 5 hrs sleep prior to accident
- Subsequently diagnosed with mild sleep apnea

10 fatalities
3 serious injuries
2 minor injuries
5 no injuries

Source: Oklahoma State Police

Probable Cause (fatigue)

"... driver's fatigue, caused by the combined effects of acute sleep loss, circadian disruption associated with his shift work schedule, and mild sleep apnea, which resulted in the driver's failure to react to slowing and stopped traffic ahead by applying the brakes or performing any evasive maneuver to avoid colliding with the traffic queue. . . ."

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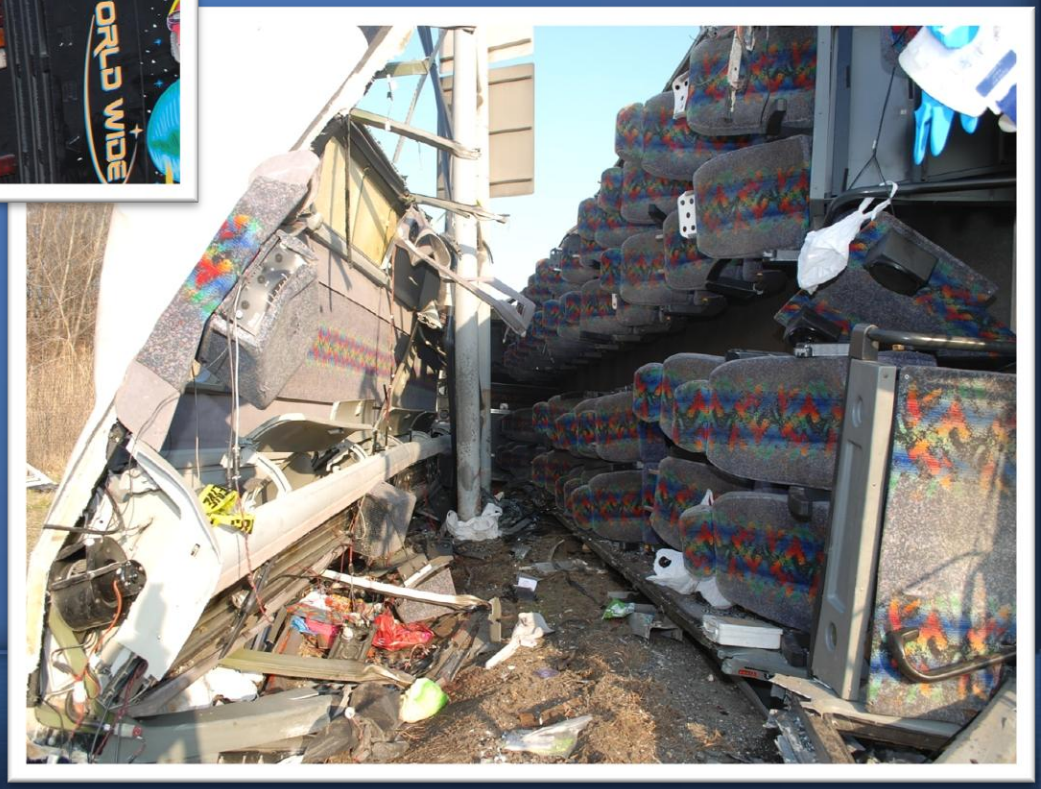
Animation of Accident Reconstruction

Motorcoach Run Off Road-Collision with Bridge Signpost

Interstate Highway 95 Southbound
New York, New York
March 12, 2011

HWY11MH005

‘Bronx Bus’, New York, NY (March 12, 2011)



15 fatalities

17 injuries

Probable Cause

"The National Transportation Safety Board determines that the probable cause of the accident was the motorcoach driver's failure to control the motorcoach due to fatigue resulting from failure to obtain adequate sleep, poor sleep quality, and the time of day at which the accident occurred."

NTSB Safety Recommendations: Fatigue

- 40 years ago: May 10, 1972
- “Revise FAR 135 to provide adequate flight and duty time limitations.” (A-72-55)
- Classified “Closed-Unacceptable”

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SHARE

MOST WANTED LIST

A program to increase the public's awareness of, and support for, action to adopt safety steps that can help prevent accidents and save lives.
The following are ten of the current issues.

Addressing Human Fatigue

General Aviation Safety

Safety Management Systems

Runway Safety

Bus Occupant Safety

Pilot & Air Traffic Controller Professionalism

Recorders

Teen Driver Safety

Addressing Alcohol-Impaired Driving

Motorcycle Safety

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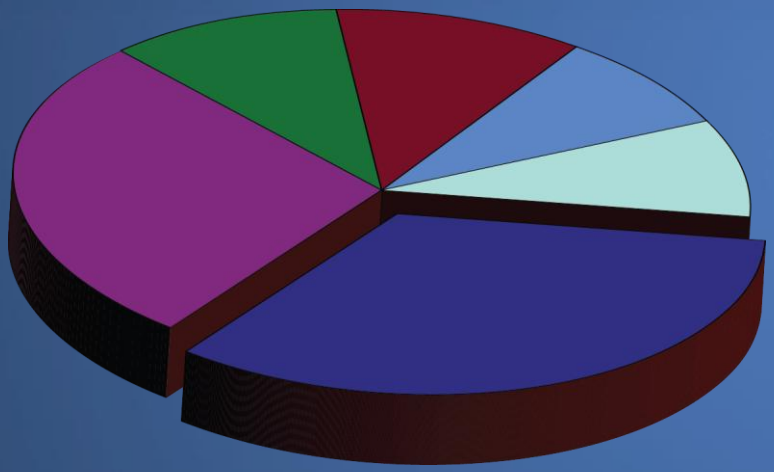
NTSB Recommendations

- MOST WANTED 1990 -2012
- ~200 fatigue recommendations

Complex Issue:



Requires Multiple Solutions

- Scheduling Policies and Practices
- Education/Awareness
- Organizational Strategies
- Healthy Sleep
- Vehicle and Environmental Strategies
- Research and Evaluation

NTSB Fatigue Recommendations: Fatigue Management Systems

- Develop guidance based on empirical and scientific evidence for operators to establish fatigue management systems

- Establish an ongoing program to monitor, evaluate, report on, and continuously improve fatigue management programs implemented by motor carriers to identify, mitigate, and continuously reduce fatigue-related risks for drivers.

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